

AMENDMENT TO THE SPECIFICATION

Please delete the TECHNICAL FIELD section on page 1 following the title of the invention.

Please replace RELATED APPLICATIONS section on page 1 with the following text:

~~--RELATED APPLICATIONS~~ RELATED APPLICATIONS

a1 [002] This application is a continuation-in-part of U.S. Patent No. ~~6,061,603~~ which is a continuation-in-part of U.S. Patent Application No. 09/303,458, now U.S. Patent No. 6,151,625, which is a continuation-in-part of U.S. Patent Application No. 08/927,005, now U.S. Patent No. 6,282,454. This application is also related to the following, commonly assigned application, entitled "Apparatus for Controlling Internetwork Communications," U.S. Patent Application No. 08/926,837. The contents of these Applications are expressly incorporated herein by reference. --

After the RELATED APPLICATIONS section on page 1, please add the following text:

--~~TECHNICAL FIELD~~

a2 Applicants' invention relates generally to the field of factory automation devices and more particularly to a system for coupling a network of factory automation devices through an internetwork to a monitoring and control device.--

Please replace the heading "BACKGROUND OF THE INVENTION" on page 1 with "BACKGROUND OF THE INVENTION".

Please replace the heading "SUMMARY OF THE INVENTION" on page 3 with "SUMMARY OF THE INVENTION".

Please replace the heading "BRIEF DESCRIPTION OF THE DRAWINGS" on page 4 with "BRIEF DESCRIPTION OF THE DRAWINGS".

Please replace the Detailed Description section of the specification (on page 4) with the following text. The support for the changes can be found in the Figures and in the Claims. In addition, each paragraph has been numbered to facilitate discussions with the Examiner.

~~DETAILED DESCRIPTION~~ DETAILED DESCRIPTION

93 [022] Although this invention is susceptible to embodiments of many different forms, a preferred embodiment will be described and illustrated in detail herein. The present disclosure exemplifies the principles of the invention and is not to be considered a limit to the broader aspects of the invention to the particular embodiment as described.

[023] Figure 1 shows an overview block diagram of a system illustrating the relationship between a user 2 at a remote location interfacing with a web browser 10 and an Internet web site 4 personal computer 8 used for programming an application software of a factory automation device, preferably a PLC 32.

[024] Figure 2 shows a block diagram of the relationship between the User 2, and the web browser 10 that is running on a personal computer 8. This personal computer 8 is connected to a network 14. The network is also connected to the PLC 32 and to a web site 4. The web site 4 contains the application program 22 for operating the PLC 32 and the programming device 21 for editing the application program 22.

[025] Figure 3 shows the relationship of the web site 4 to the PLC 32. In this figure, the PLC 32 is connected to I/O devices 40 and to the network 14. Also connected to the network 14 is the web site 4. The web site 4 includes a network interface 16 that has an address 18. The web site also includes a programming device 21, a program package 33, and an application program 22. The program package 33 includes web pages 35, a symbol editor 37 and a language editor 39.

[026] In Figure 4, the user 2 will have a programming device 21, preferably a personal computer (PC) 8, having a commercially available browser 10, such as Netscape Communication's Navigator or Microsoft's Internet Explorer, installed for viewing the contents at the web site 4 through a network 14, such as the Internet-14. The PC 8 provides a remote human-machine interface (HMI) to the communication network 14 and the devices operably connected on the network. Various interconnection services are readily available to provide the physical and electrical interconnection from the PC 8 to the Internet 14. The Internet 14 is a collection of independent world wide communication networks that are interconnected to each other and function as a single connectionless entity. Communication is based on a client-server basis, using a number of established protocols that allow for communication and file transfers between the client and the server. The most widely used protocol is Internet Protocol (IP).

[027] The web site 4 includes a network interface 16 having an unique Internet address 18, a server 20, and an application program 22. The server 20 acts as a hypertext transfer protocol (HTTP) interpreter which uses Transmission Control Protocol (TCP) in conjunction with Internet Protocol, through a Transmission Control Protocol/Internet Protocol (TCP/IP) stack 24 to interact with the network interface 16 and the application program 22. This enables the transfer of the application program 22 to the PLC 32 through the Internet 14. The application program 22 provides an operating program to the PLC 32. The PLC 32 operating program can be created or edited remotely from the PLC and then transmitted to the PLC for use in the communication network when desired. The TCP/IP stack 24 enables data transfers over the Internet 14 between the user 2 and the web site 4 as required for the various layers specified by the IP protocol.

[028] The user 2 can connect to the Internet 14 using one of a number of Internet service providers and will enter the address of the web site 4 when connected. The web site 4 will display a home page which may contain text, some type of multimedia offerings such as graphic images, video, or audio, and possible hypertext links to other documents. The browser 10 will allow the user 2 to view the page and interact with the choices associated with it. The browser 10 will send commands to the web site 4 which will use the application program 22 to display whatever information is available from the PLC's operating program. The browser 10 functions as a remote human-machine interface (HMI) with the communication network and PLC's operating program.

AB [029] Figure 2 4 shows a basic block diagram of the present invention illustrating an Internet interface to a communication network having a PLC 32 and a programming device 21. The web site 4 includes the network interface 16 having an unique Internet address 18 and a web server 30. The web server 30 provides the home page for the website 4. A firewall or security for the overall system can be included in the web server 30, but is generally maintained as part of the network interface 16. In addition to providing security for various pages at the site, the user can disable the web server 30. A password and user list is provided in initial configuration files stored in the web server 30 that are downloaded from a remote server. Protection of the configuration file is then provided by the remote server and the web server 30 through the password and the user list. The web server 30 provides a direct connection for a programming device 21 to the Internet. The web server 30 provides both a client and server interface. All signals between the programming device 21 and the web server 30 can be through the network 34. The communication signals include addressing, control, data, and power. The client interface allows a user to send commands to a remote node over the Internet and the server interface allows for processing commands that originated from a remote node. Creating and editing the PLC operating program from a remote HMI is possible without involving the resources associated with the PLC 32.

[030] Associated with the PLC 32 are its application programs 36 22, ~~dual port memory~~ 38, programming device 21 and Input/Output (I/O) modules 40. The application programs 36 22 include a ladder logic program for controlling the I/O modules 40 of the network. The web server 30 functions as a node on a TCP/IP network 42 14 allowing it to send data and commands to a device on the network and receive the response. Although the TCP/IP network 42 14 in the preferred embodiment is an Ethernet network, other high level protocols could be used. Using a web browser at a remote location through the Internet-14, a user can view and edit the PLC's operating program.

[031] A program package 33, using either Java or HTML, resides within a programming device 21. The programming device 21 is operably connected to the network and can be physically placed near or far from the PLC 32. The program package 33 is based on Ethernet and Web technology and allows editing of the application program 36 22 by the user using a programming device 21, preferably a personal computer 8. The application programs 36 22, stored as either a ladder logic or an IEC 1131 language program, are

viewed and saved as PLC programs within the programming device 21, accessible using either the standard HTTP or custom PLC protocols that run over TCP/IP. The information needed to edit the operating program, including web pages for the editing procedures, reside in the programming device 21, preferably the program package 33. The program package 33 converts the PLC operating programs to and from formats needed for editing with a browser 10. The program package 33 also includes a symbol editor 37 and a language editor 39. The user 2 will be able to view, create and edit the PLC application programs 36 22 from anywhere a browser 10 is available. A firewall or security for the programming device 21 maintained as part of its network interface prevents unauthorized users from accessing the program package 33.

43 [032] In addition to providing the ability to edit the application programs 36 by providing a File Transfer Protocol (FTP) based view of the application programs 36, file backup and restore can be handled through standard programming tools, allowing the user to manage the application programs 36 directly and efficiently and to also use standard revision control software to manage the application programs 36. Further, since all the symbols can be stored within the programming device 21, any device capable of interfacing with the network 14, i.e., PDA, cell phone, etc., can be used to edit the application program 36. Alternatively, the comments and symbols can be stored on another network device, such as a PC, that is physically separated from the programming device 21.

[033] Figure 5 shows an alternative configuration wherein some or all of the components of the web site 4 reside on the PLC. This figure shows the components of a web server module for a PLC. The web server module is connected to the network 42 and is connected to the programming device 21. The programming device contains a program package for programming the PLC. Inside of the web server module is a CPU 46 that runs a real time operating system 44. Also running on the CPU 46 is an Ethernet driver 48, a TCP/IP stack 54, and a programming device driver 55. The TCP/IP stack 54 could also be a dual TCP/IP stack. Interfacing between the TCP/IP stack 54 and the programming device driver 55 are a number of tasks to perform various functions. There is a client task 58 and server task 60 that handles network communication. The FTP task 59 handles functionality required to respond to network requests or to create network requests that use the FTP protocol. The HTTP task 62 handles the functionality required

to respond to or generate requests using the HTTP protocol. The Ethernet driver 48 contains a memory 52 and an address 18.

Q3 [034] A user at a remote location can edit the operating program of the PLC 32 by accessing a web page associated with the program package 33 via the Internet. A mimic page shown in Figure-4, 6, represents some of the hardware physically connected to the programmable logic controller system that can be constructed utilizing graphical editing techniques that are part of the present invention. The present invention allows a user at a remote location, using a browser, to create and edit a PLC operating program by adding and deleting various components illustrated in the mimic page. Figure -4 6 shows a simple motor start-stop control in ladder logic diagram form that could be available as a mimic page to the user. The mimic page diagram will be accessed using a browser which will allow the user to view the graphic representing the operating program of the PLC 32. Rearranging the components on the mimic page will result in a different operating program. The program can be saved on the programming device 21 for later transfer to the PLC 32. Alternatively, the user can edit or create the PLC's operating program without using the graphic mimic page.

[035] It is also to be understood by one of ordinary skill in the art that the communication network can comprise any combination of wired and wireless technology.

[036] While the specific embodiments have been illustrated and described, numerous modifications are possible without departing from the scope or spirit of the invention.

Please replace the heading "CLAIMS" on page 9 with "CLAIMS".